CLAIMS

1. A ultrasonic motion detecting device, comprising:

first and second ultrasonic transducers having piezoelectric elements arranged in an array, which transmit ultrasonic waves to an object and acquire reflection signals from the object;

a motion detection unit that extracts an estimation region which is used for estimating a motion of the object from the reflection signals that are acquired by the first and second ultrasonic transducers, and detects a three-dimensional motion within the estimation region; and

an image display unit that displays the three-dimensional motion within the estimation region,

wherein ultrasonic wave scanning surfaces due to the first and second ultrasonic transducers cross over each other.

2. The ultrasonic motion detecting device according to claim 1, wherein the first and second transducers alternately conduct ultrasonic scanning to acquire a biplane image including two scanning surfaces which are not in parallel to each other.

3. The ultrasonic motion detecting device according to claim 1, wherein the first and second transducers alternately transmit and receive ultrasonic beams to acquire a biplane image.

4. The ultrasonic motion detecting device according to claim 1, wherein the signal component used for estimating the motion comprises a contour component of the object, a speckle

component occurring by allowing the reflection signals from point reflectors that are scattered within a body of the object to interfere with each other, or a combination of the contour component with the speckle component.

5. The ultrasonic motion detecting device according to claim 1, wherein a plurality of estimation regions are set to estimate the partial motions of the object to detect the movement and/or deformation of an inspection region within the object.

6. The ultrasonic motion detecting device according to claim 1, wherein a correlation function of a plurality of one-dimensional signals of the reflection signals that are acquired by the first and second ultrasonic transducers is conducted within the estimation region.

7. The ultrasonic motion detecting device according to claim 1, wherein the motion estimation is conducted on the respective biplane images consisting of the two scanning surfaces to detect the velocity components of the three-dimensional motion of the object.

8. The ultrasonic motion detecting device according to claim 1, wherein the imaging cross-section is changed according to the motion of the object to display the focusing image of the object on the image display unit in real time.

9. An ultrasonic therapeutic device that combines therapeutic transducers with the ultrasonic motion detecting

device according to claim 1, wherein a focal point of the therapeutic ultrasonic waves of the ultrasonic therapeutic device focuses on the motion of the object.

10. The ultrasonic therapeutic device according to claim 9, wherein the three-dimensional motion of the object and an automatic focusing state of the focal point of the therapeutic ultrasonic waves in correspondence with the three-dimensional motion are displayed on the image display unit as a three-dimensional real moving image, and the biplane images of the object is displayed on the image display unit at the same time.

11. An image producing device using the ultrasonic motion detecting device according to claim 1, the image producing device comprising:

an imaging cross-section ascertaining unit that estimates a relative motion from an initial position of the imaging cross-section due to the first and second ultrasonic transducers according to the result of the motion that is detected by the motion detection unit to determine the positions of the imaging regions produced by the first and second ultrasonic transducers;

a three-dimensional image memory unit that stores the three-dimensional image of the object therein;

an initial cross-sectional position setting unit that sets a two-dimensional image that is extracted from the three-dimensional image which corresponds to the initial

position as an initial position; and

an image extraction unit that changes the extracted cross-section which is set by the initial cross-sectional position setting unit according to a change in the imaging cross-section due to the first and second ultrasonic transducers which is ascertained by the imaging cross-section ascertaining unit to extract a corresponding two-dimensional high-resolution image from the three-dimensional image memory unit,

wherein the extracted image is displayed on the image display unit as needed.

12. The image producing device according to claim 11, wherein the three-dimensional image comprises any one of an MRI image, an X-ray CT image, and a PET image.

13. The image producing device according to claim 11, wherein an initial position of the imaging cross-section due to the first and second ultrasonic transducers and an initial position in the three-dimensional image in correspondence with the initial position of the image cross-section are set by using positional information on a characteristic region of the object such as xiphoid process of the sternum.

14. The image producing device according to claim 11, wherein the three-dimensional image includes an image of an artificial contrast material that is attached to an interior or an exterior of the object, and an initial position of the

imaging cross-section due to the first and second ultrasonic transducers and an initial position in the three-dimensional image in correspondence with the initial position of the image cross-section are set on the basis of a position of the contrast material.

15. The image producing device according to claim 11, wherein an initial position of the imaging cross-section due to the first and second ultrasonic transducers and an initial position in the three-dimensional image in correspondence with the initial position of the image cross-section are set at a position where an integration value of an absolute value of a difference value between the ultrasonic image due to the first and second ultrasonic transducers and the extracted image that is extracted from the three-dimensional image becomes smallest.

16. The image producing device according to claim 11, wherein a plurality of estimation regions are set to estimate the motion of the object, thereby detecting a shift and/or a deformation of an inspection region in the interior of the object.

17. The image producing device according to claim 11, further comprising: an extracted image reconstruction unit that sets a plurality of estimation regions to interpolate the plurality of extracted cross-sections to continuously combine the estimation regions with each other, and reconstructs the two-dimensional extracted image.